Planning for use of environmental water assets in 2007

Potential management actions based on recent scientific investigations

Jim White
Kevin Fleming
California Department of Fish and Game

EWA Review
Nov 28,2006

Hypotheses suggested by presentations at the recent CALFED Science Conference may provide the basis for adaptive management experiments in WY 2007.

Current events

- Fish species in trouble
- Preliminary results from POD investigations at Oct. 2006 CALFED Science Conference
- Agency managers ask for water management actions to help fish framed as experiments to test hypotheses
- Consistent with past EWA review panel recommendations
  - Be more explicit about rationale for actions
  - Describe expected response and measure it
- Requesting feedback from this panel

Overview of action matrix

- **Winter/Spring:** ***habitat conditions***
  - Flow direction in south Delta channels
  - delta smelt adults, larvae and juveniles
- **Summer:** ***Food web enhancement***
  - Yolo bypass flows
  - Clifton Court Forebay gate operations
  - Zooplankton production, distribution, removal
- **Summer/Fall:** ***habitat conditions***
  - X2 location
  - Higher EQ Index
  - delta smelt distribution, survival, health

Narrow the focus for today

- Examine those water management actions
  - with linkage to EWA
  - most likely to produce intended result (lowest degree of “uncertainty”)
  - implement this water year

- Other potential actions not being discarded

Potential Actions

January – February

- Old River/Middle River flow - adult delta smelt distribution and entrainment risk

March – mid April

- Old and Middle River flow - larval delta smelt entrainment

April – May

- VAMP conditions without south Delta barriers – larval and juvenile delta smelt

Resources Agency Action Matrix Components

- Timing
- Experiment
- Trigger
- Scientific Uncertainty
- Action
- Evidence
- Response Variable
- Detection
- Time to Detection
- Ongoing Studies

California Resources Agency Action Matrix (draft November 22, 2006)

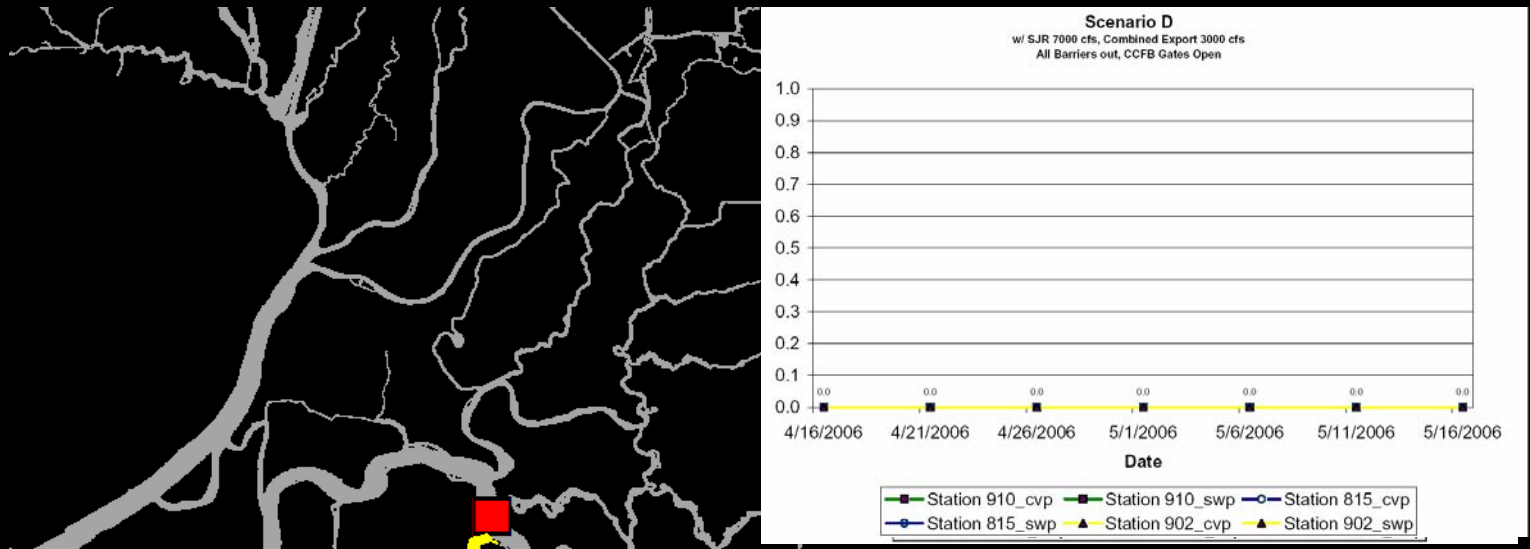
Timing	Experiment	Triggers	Scientific Uncertainty[1]	Action	Evidence	Response Variable(s)	Detection[2]	Time to Detection[3]	Ongoing Studies
Late Spring	VAMP (larvae)	Existing VAMP protocol determines experimental conditions	Low	VAMP with no South Delta Barriers	Hatch date distributions from FMWT in recent years largely encompassed by VAMP period	Otolith-based hatch dates from FMWT fish	medium	1 year	FMWT & Otoliths
Winter/Early Spring	X_2 and O&M R Flows (larvae)	If on March 1st X_2 14 day running average is east of 65 km, then take action when ripe females found in SKT and/or Delta water temperatures reach ?12°C	Medium-high	O&M R flow at zero or positive for at least 2 weeks prior to VAMP (the longer provided the more likely to see a response)	• Larger larvae in 20MM survey 4 • Ripe smelt months in advance of most FMWT survivors	1. Otolith hatchdates from FMWT fish 2. Higher FMWT Index 3. Increased number and/or proportion of larger larvae by 20 mm survey 4 4. Larger fish in FMWT	1. Medium 2. Low 3. Medium 4. Low	1. 1 year 2. 5 years 3. 2-5 year 4. 5 year	1. FMWT & Otoliths 2. FMWT 3. 20MM 4. FMWT
	Winter O&M River Flows (adults)	Take action if flows are less than -3500cfs	High	Maintain O&M River flows greater than -3500cfsJanuary and February	Relationship between O&M River flows and adult salvage	Salvage decrease in line with salvage vs. flow regression analysis Effect on population contingent on subsequent conditions affecting survival	High	1 year	O&M River flow monitoring Fish facilities sampling
Summer	Daytime operations of Clifton Court Radial Gates (food web enhancement)	Take action when water temperatures ?24°C	High	Operate Clifton Court Radial Gates only during the day	• Pseudodiaptomus forbesi epicenter in central Delta • Delta smelt-P. forbesi distribution overlap	1. Higher plankton abundance in Suisun/west Delta; increased P. forbesi co-occurrence with smelt 2. Higher ratio of *P. forbesi* nauplii to adults 3. Better glycogen scores from TNS and/or FMWT smelt	1. Low 2. Low 3. Low	1 and 2. 1 year; if a new *P. forbesi* flux experiment initiated 3. 5 years	FMWT, TNS, Histopathology Neomysis/ Zooplankton survey, 20mmSurvey Zoopl data
Summer-Fall	Summer-fall X_2 positions (Juveniles)	Take action if October-April precipitation has been above-normal If below-normal or drier water year type, no added summer-fall X_2 action	High	X_2 ? 80 km during May-December	• Fall hydro change • Fall X_2 (salinity) change • Fall Environmental Quality Index change	1. Measures of EQ index 2. Broader fish distribution 3. Higher TNS index in following year 4. Improved health of smelt in fall (histopathology) 5. Reduced adult entrainment following year 6. Improved fall-summer stock-recruit relationship	1. High 2. High 3. Low 4. Low 5. Low 6. Low	1. 1 year 2. 2-5 years 3. years 4. 5 years 5. Unknown 6. 5 years	FMWT, Histopathology and other summaries of IEP monitoring datasets
Summer	Summer Yolo Bypass connectivity (Food web enhancement)	No trigger necessary	Very High	Explore ways to add Yolo Bypass flow into Cache Slough during summer	• Yolo bypass generates primary productivity • Net flows move upstream at Cache Slough	Net flow in Cache Slough and *P. forbesi* flux down Cache Slough	Low	Unknown	Requires initiation of a zooplankton flux study in Cache Slough and adjacent areas

[1] Scientific Uncertainty – indicates the confidence that the proposed Action will have a demonstrable population benefit.
[2] Detection – confidence in our ability to detect change in response variable
[3] Time to Detection – Rough estimate of time required to see action affect on response variable. Note: although many of the response variables could show a response in the first year, one year's worth of data (positive or negative) is not sufficient to test the effectiveness of the action.

VAMP period without barriers

- Mid-April to Mid-May
  - Salmon smolt survival experiment
    - specifies San Joaquin River inflow and export pumping rate
    - Barrier at Head of Old River and 3 other locations
  - Potential effect of barriers on delta smelt from PTM results
- Action: no barriers in spring
- Expected result (hypothesis)
  - shrink “zone of entrainment”
  - higher survival of larvae and juveniles

VAMP with no South Delta Barriers



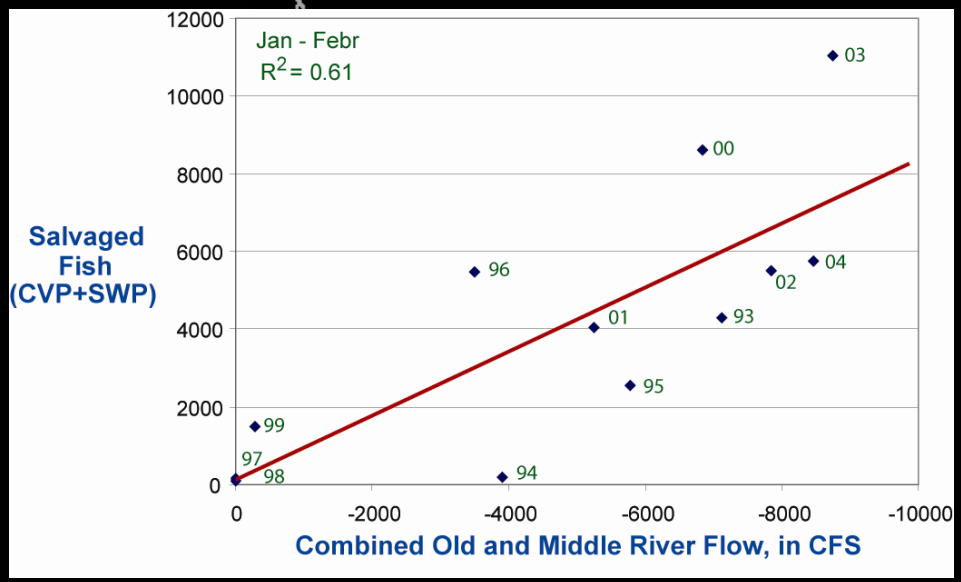
SJR Flows = 7000cfs
Exports = 3000cfs

24 0% to 4% of the particles entrained

Adult delta smelt entrainment

- January – February
- Action: reduce reverse flow in Old and Middle rivers combined to no more than 3,500 cfs in the upstream direction
- Triggered if ORMR flow is more negative than -3,500 cfs
- ORMR flow v. adult delta smelt salvage
- Expected result
  - Salvage consistent with historical flow v. adult salvage relationship

Winter O&M River Flows (adults)



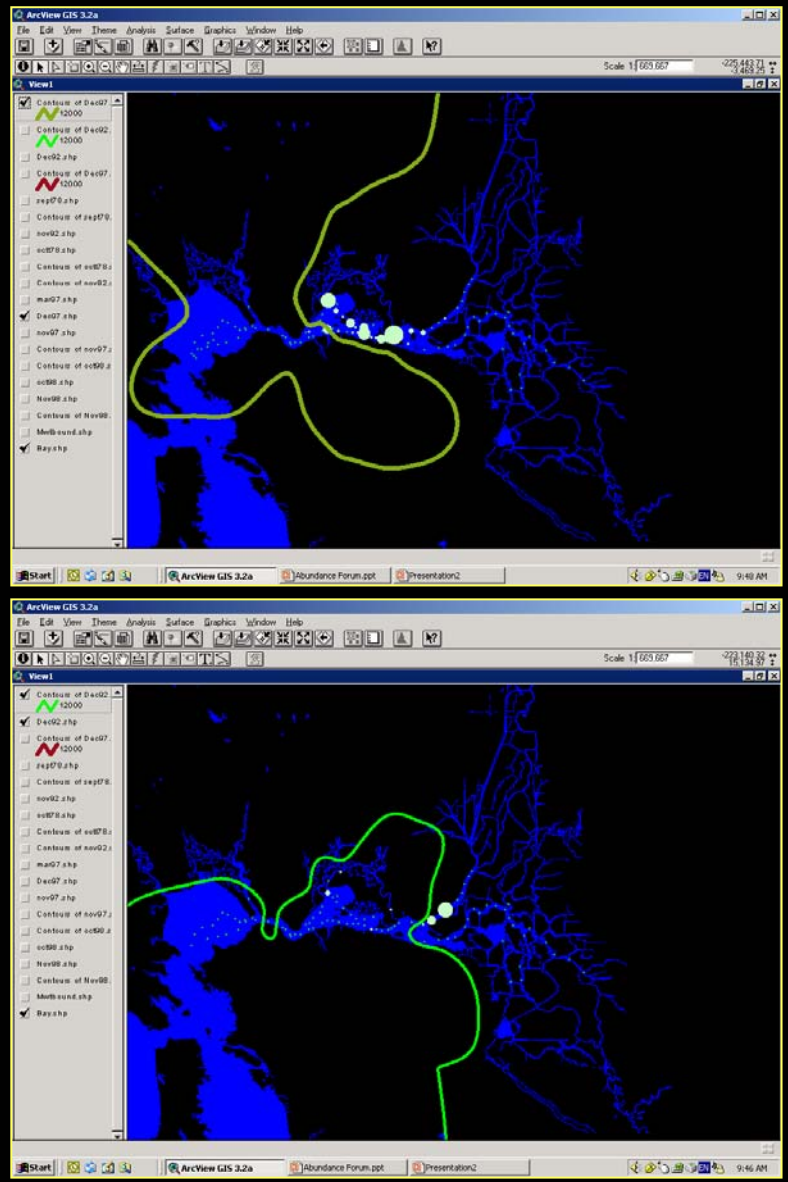
Pete Smith
USGS

Larval delta smelt entrainment prior to VAMP

- March-April
- Action: Eliminate upstream flow in Old and Middle river channels
- Triggered by initiation of spawning
- Expected results:
  - more juveniles
  - pre-adults with hatch dates in this period

TRIGGER

If on March 1st X_2 14 day running average is east of 65 km, then take action when ripe females found in SKT and/or Delta water temperatures reach ?12°C



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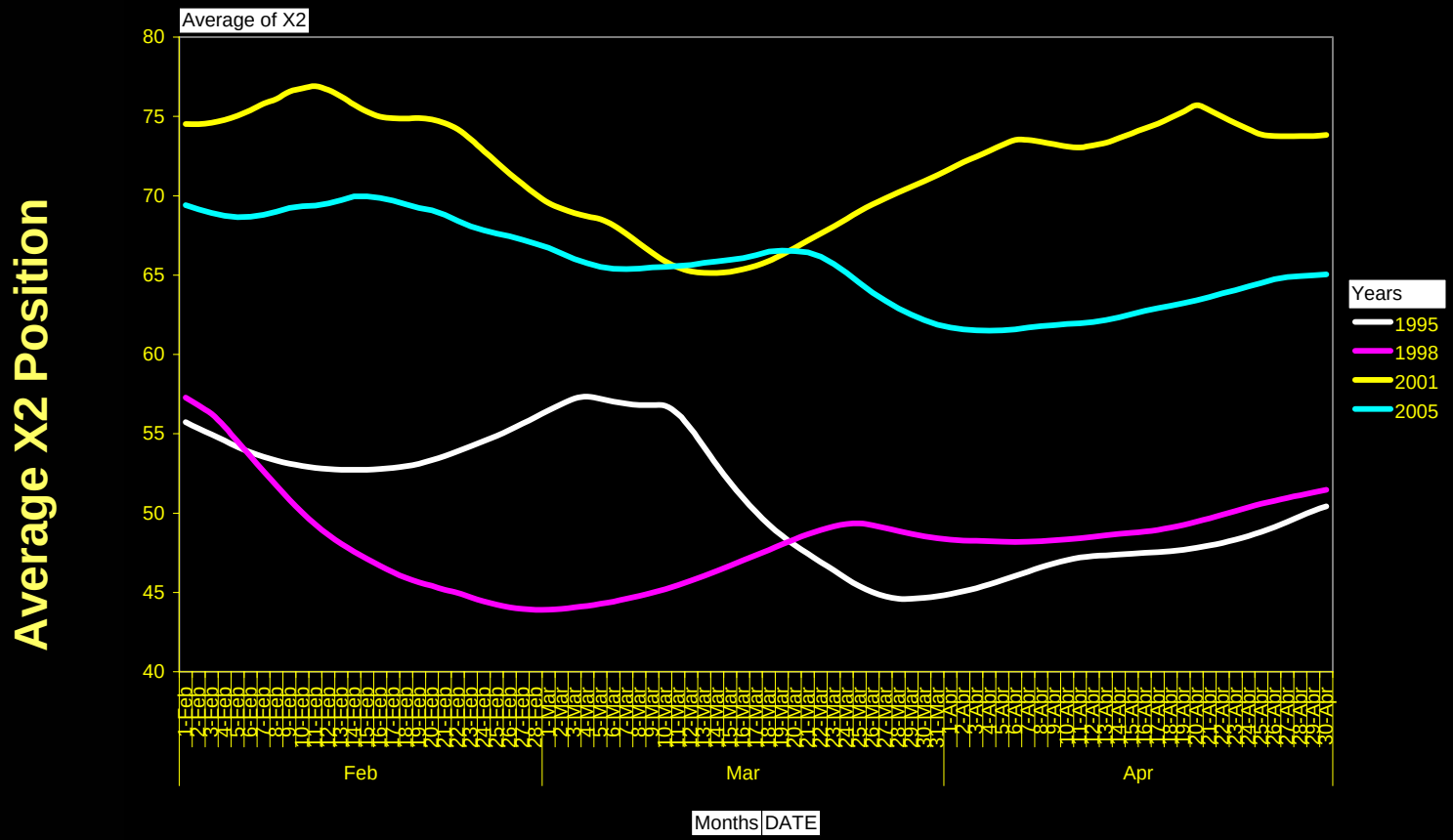

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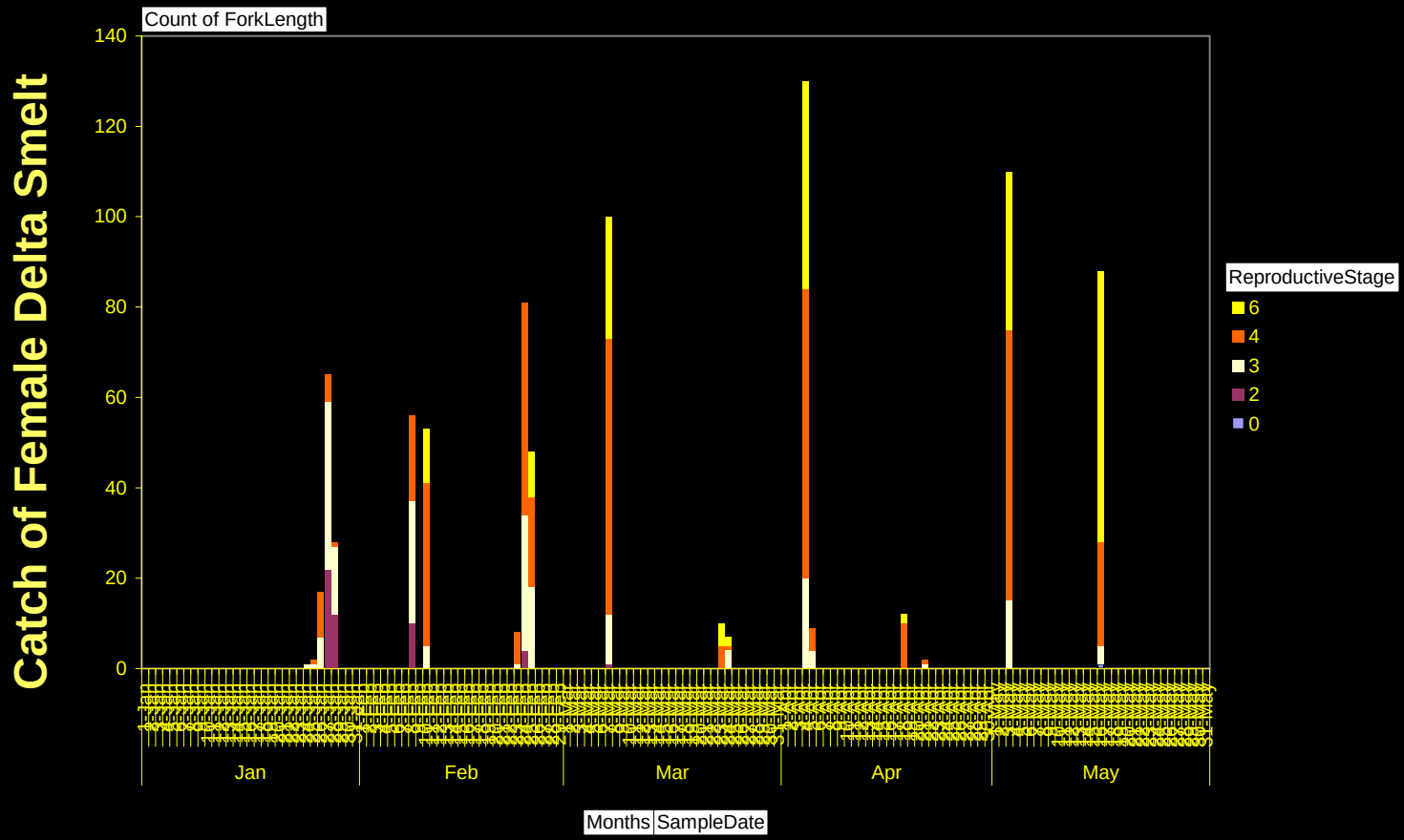

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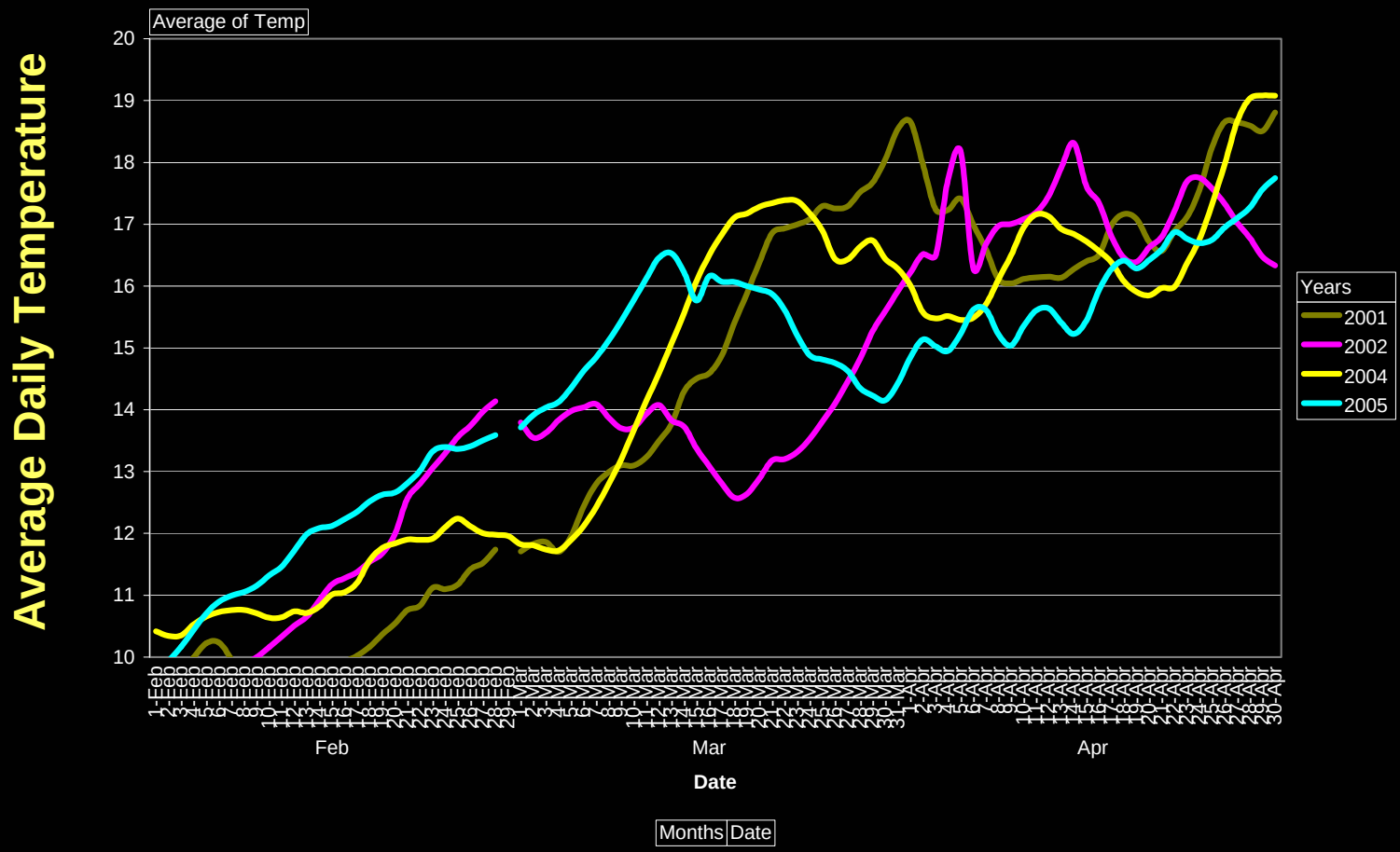

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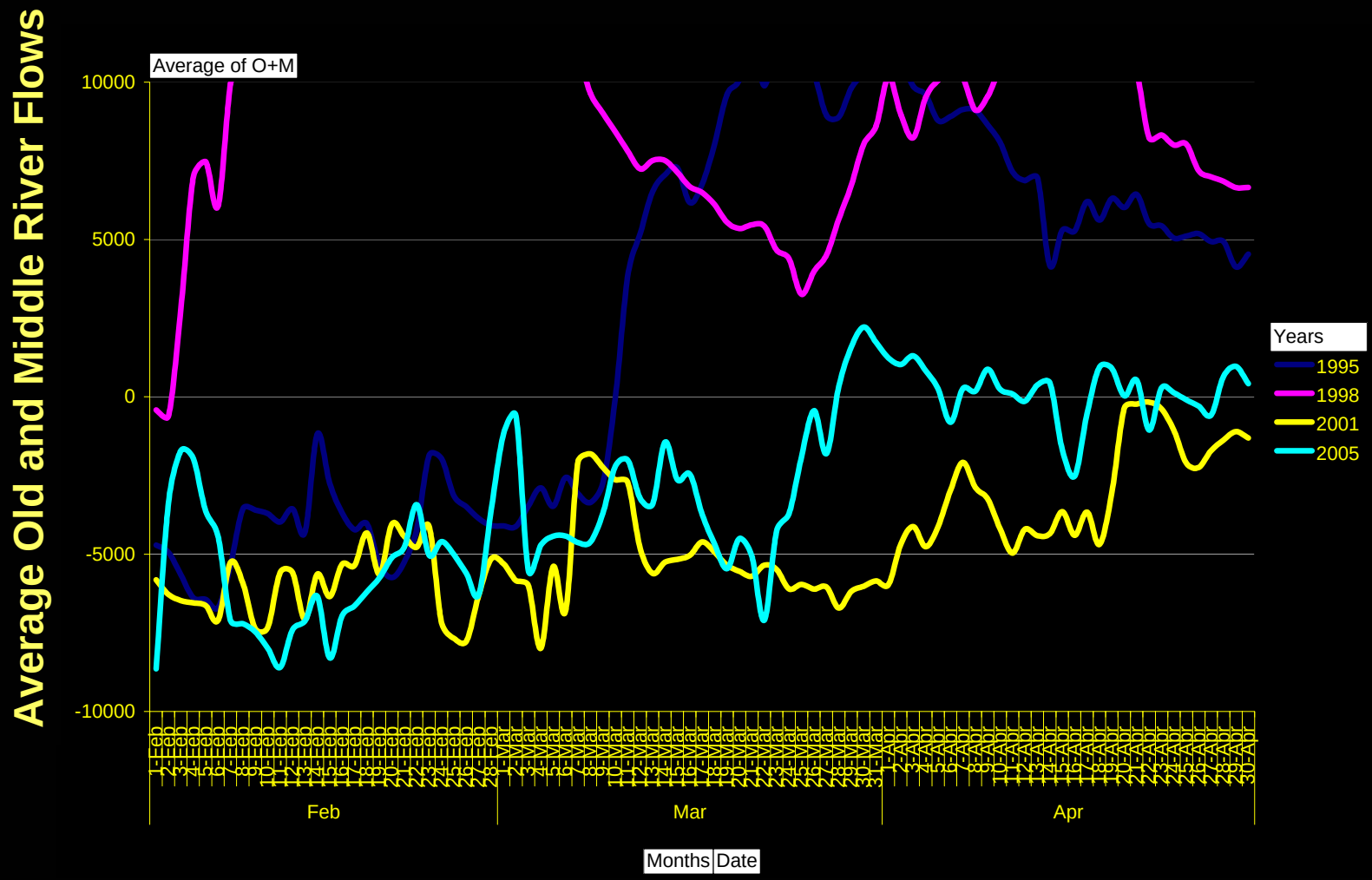
O&M R flow at zero or positive for at least 2 weeks prior to VAMP (the longer provided the more likely to see a response)



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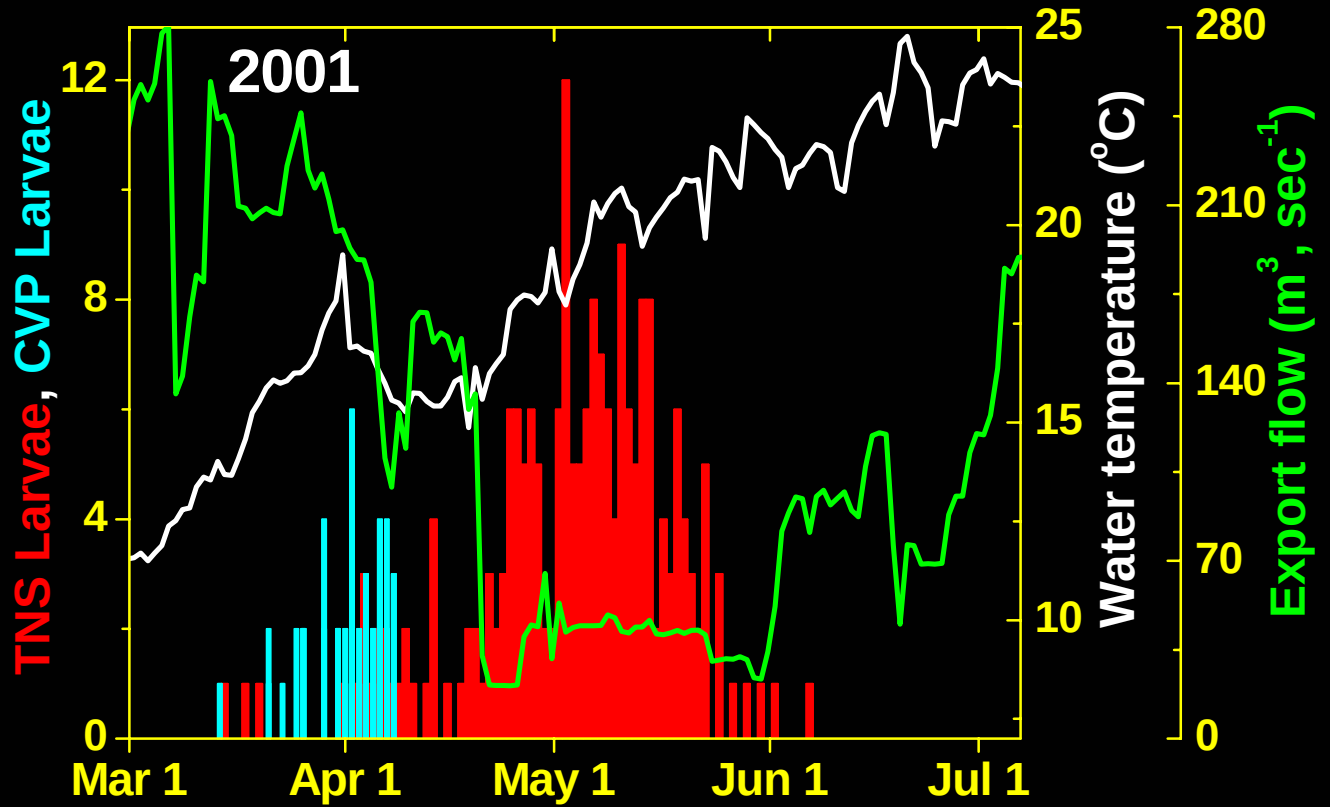
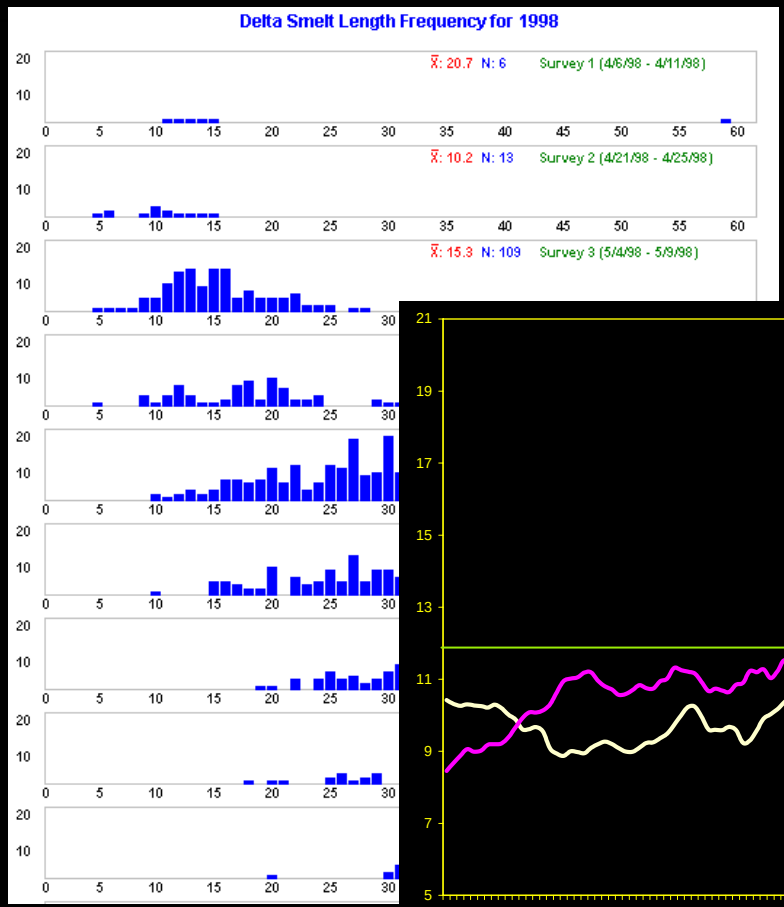
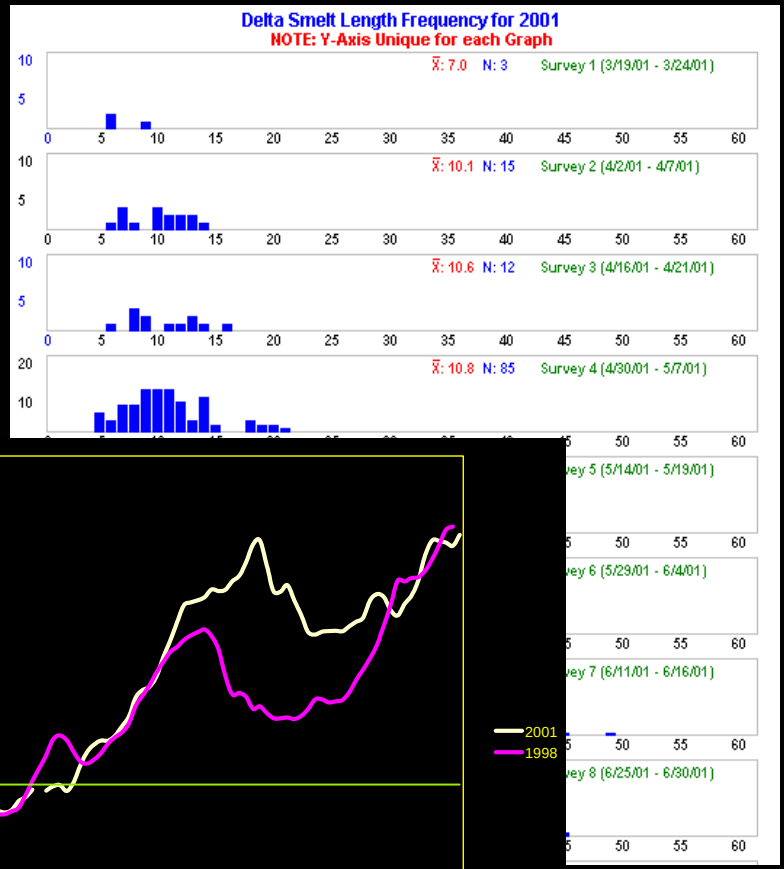


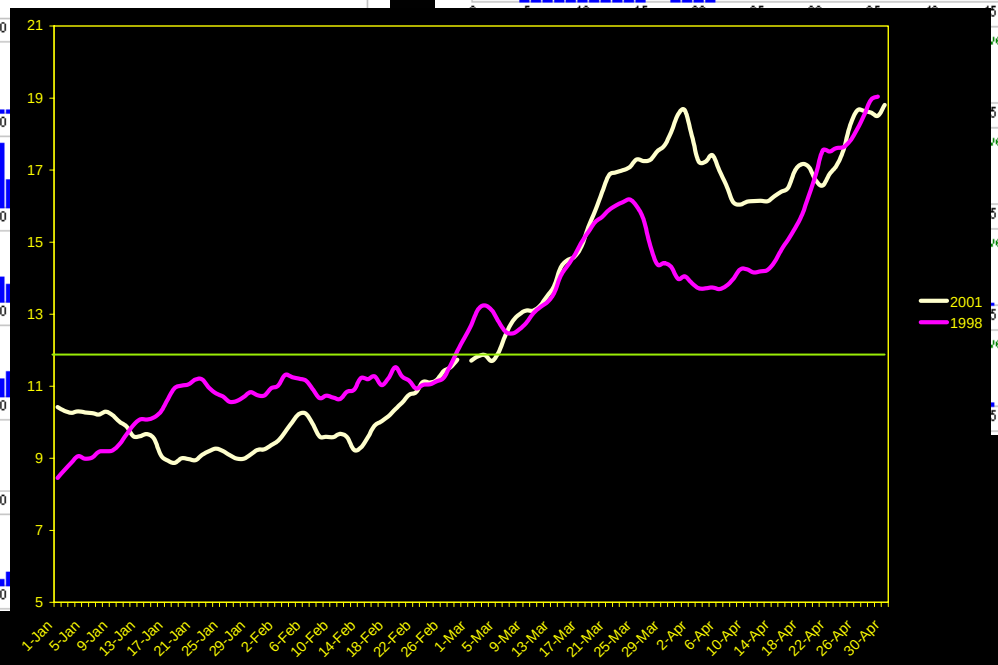
Bennett, UCD

EVIDENCE

- Larger larvae in 20MM survey 4
- Ripe smelt months in advance of most FMWT survivors







	Response Variable(s)	Detection[2]	Time to Detection[3]	Ongoing Studies
1	Otolith-based hatch dates from FMWT fish	medium	1 year	FMWT & Otoliths
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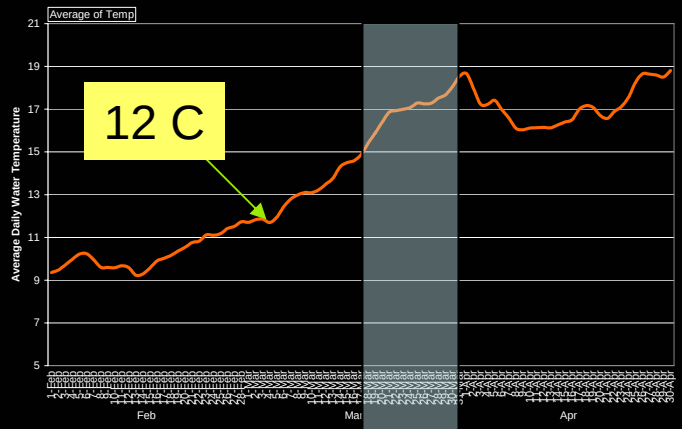
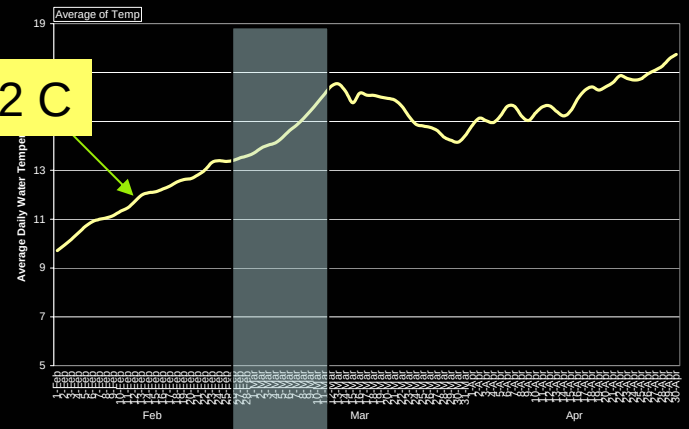
2.	Higher FMWT Index	2. Low	2. 5 years	2. FMWT
3.	Increased number and/or proportion of larger larvae by 20 mm survey 4	3. Medium	3. 2-5 year	3. 20MM
4.	Larger fish in FMWT	4. Low	4. 5 year	4. FMWT

2001

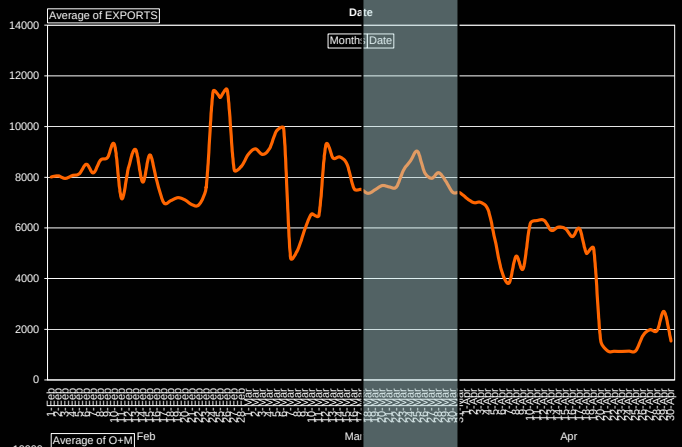
2005

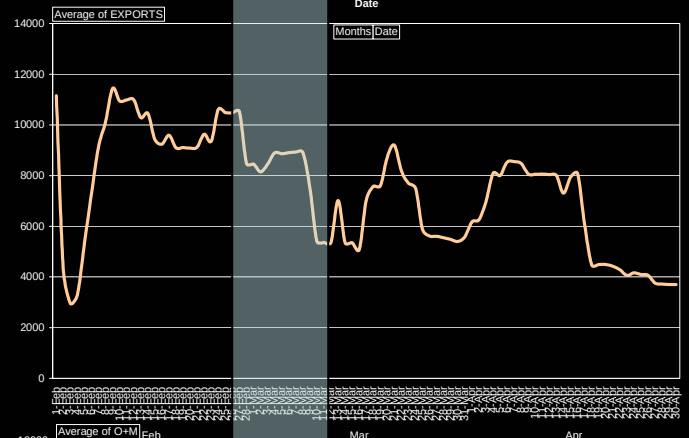
Water Temperature



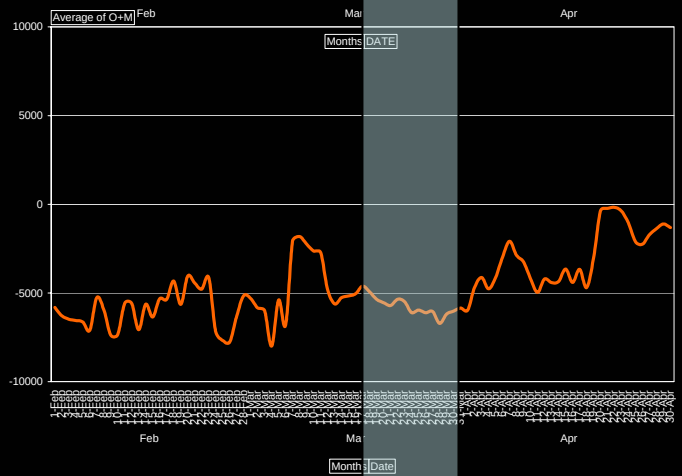


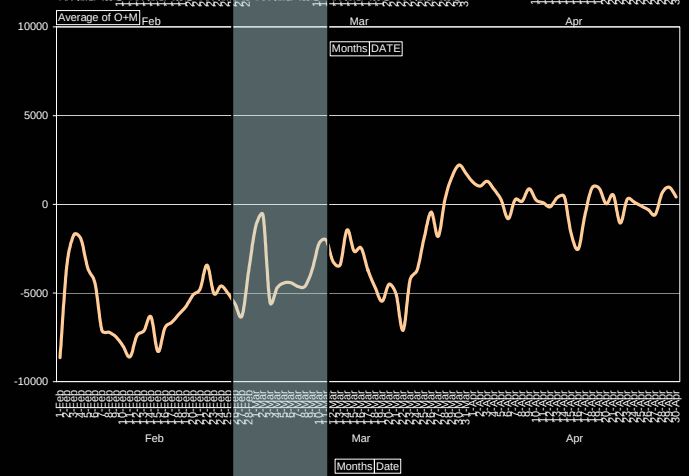
Exports

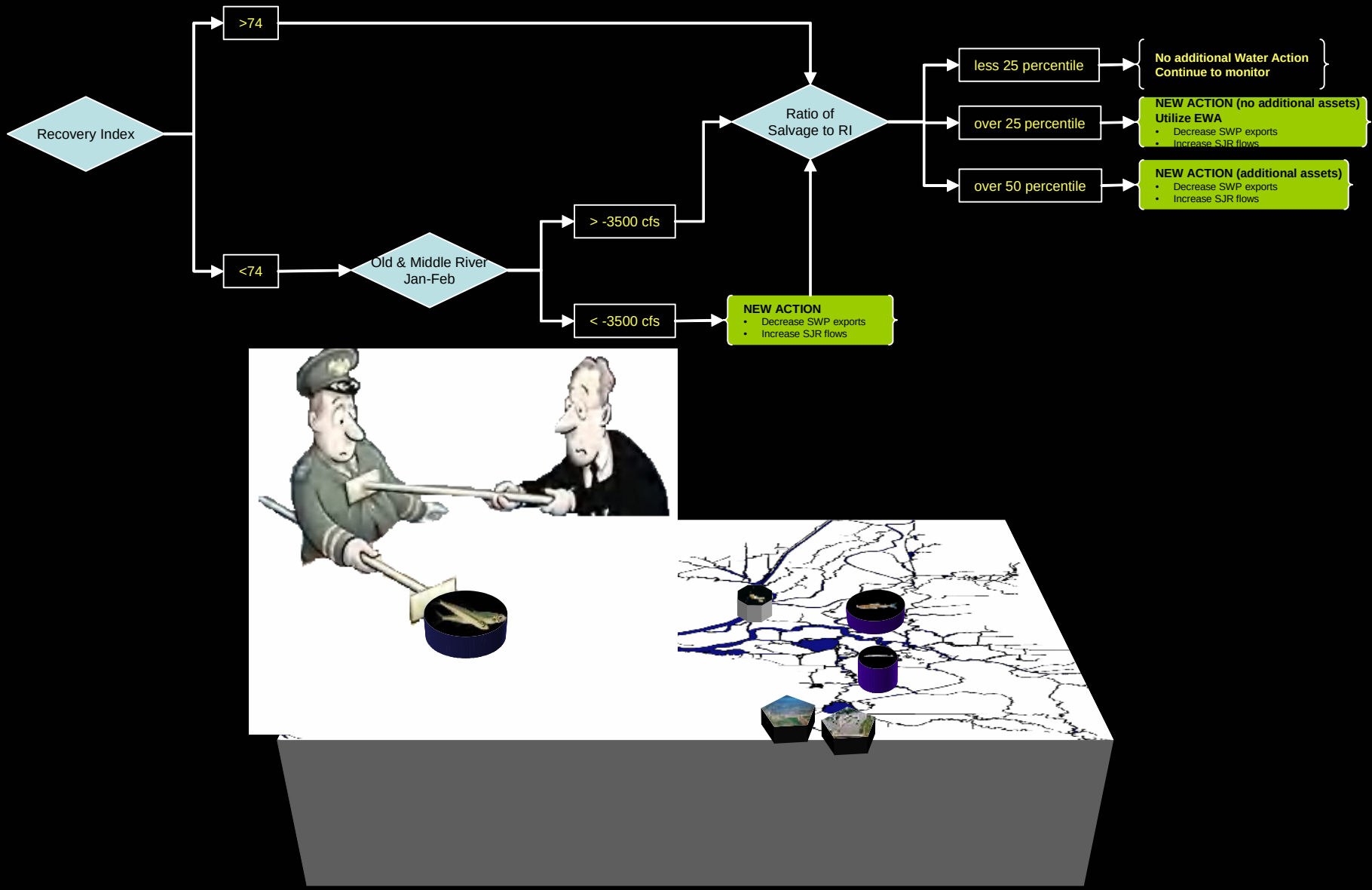




Old & Middle River






Recovery Index
>74
<74
Old & Middle River Jan-Feb
> -3500 cfs
< -3500 cfs
NEW ACTION
Decrease SWP exports
Increase SJR flows
Ratio of Salvage to RI
less 25 percentile
over 25 percentile
over 50 percentile
No additional Water Action
Continue to monitor
NEW ACTION (no additional assets)
Utilize EWA
Decrease SWP exports
Increase SJR flows
NEW ACTION (additional assets)
Decrease SWP exports
Increase SJR flows

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Experimental Considerations

- Duration and magnitude of action
  - Don’t have “with treatment” and “without treatment”
  - Create a predetermined ‘test” condition
- Water “cost” could range widely

Considerations

- Many uncontrolled environmental factors
- Tradeoffs – can data be obtained and analyzed without impacting other critical POD-related scientific work?
- Interpreting results from single experiment

Effective action = population benefit?

- Assuming the immediate response occurs
- Is response carried through to later life stages and/or next generation?
  - Example:
    - Adults live to spawn but progeny are entrained
    - Larvae survive but juveniles entrained later unless action continued
    - Juveniles make it until summer but then survive poorly due to inadequate food supply or ??

Summary

- Recognize that some of the underlying information is preliminary
- Acknowledge willingness of others to share results and ideas and to participate in this dialogue
- Advice from local and outside scientists
  - EWA Panel's charge
    - Provide them with more detail
    - Related to the entire matrix

Conclusion

- Attempt to protect fish (consistent with CA Legislature's direction)
- Progress in putting fish protection on a sounder scientific footing (direction from previous EWA review panel)
- Expand our knowledge to support future management decisions